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Generalized Geologic Map for Land-Use Planning: Lyon County, Kentucky

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Acknowledgments

Thanks to John Rudolph, Lyon County Agriculture and Natural Resource agent; and James Garner, Western Kentucky Correctional Complex, for photo assistance.

Kuttawa Marina is one of three marinas on Barkley Lake in Lyon County. The other two marinas are the Eddy Creek Marina and the Buzzard Rock Marina. Photo by Glynn Beck, Kentucky Geological Survey.

U.S. Army Corps of Engineers bank stabilization project along the Cumberland River in Lyon and Livingston Counties. Photo by Glynn Beck, Kentucky Geological Survey.

An example of the gently rolling topography in Lyon County, which is excellent for row crop agriculture. Other parts of Lyon County may have steep slopes with narrow valleys. Photo by Glynn Beck, Kentucky Geological Survey.

Barnett Spring is a karst spring, which flows year around. Karst springs are common throughout Lyon County. Photo by Glynn Beck, Kentucky Geological Survey.

EXPLANATION

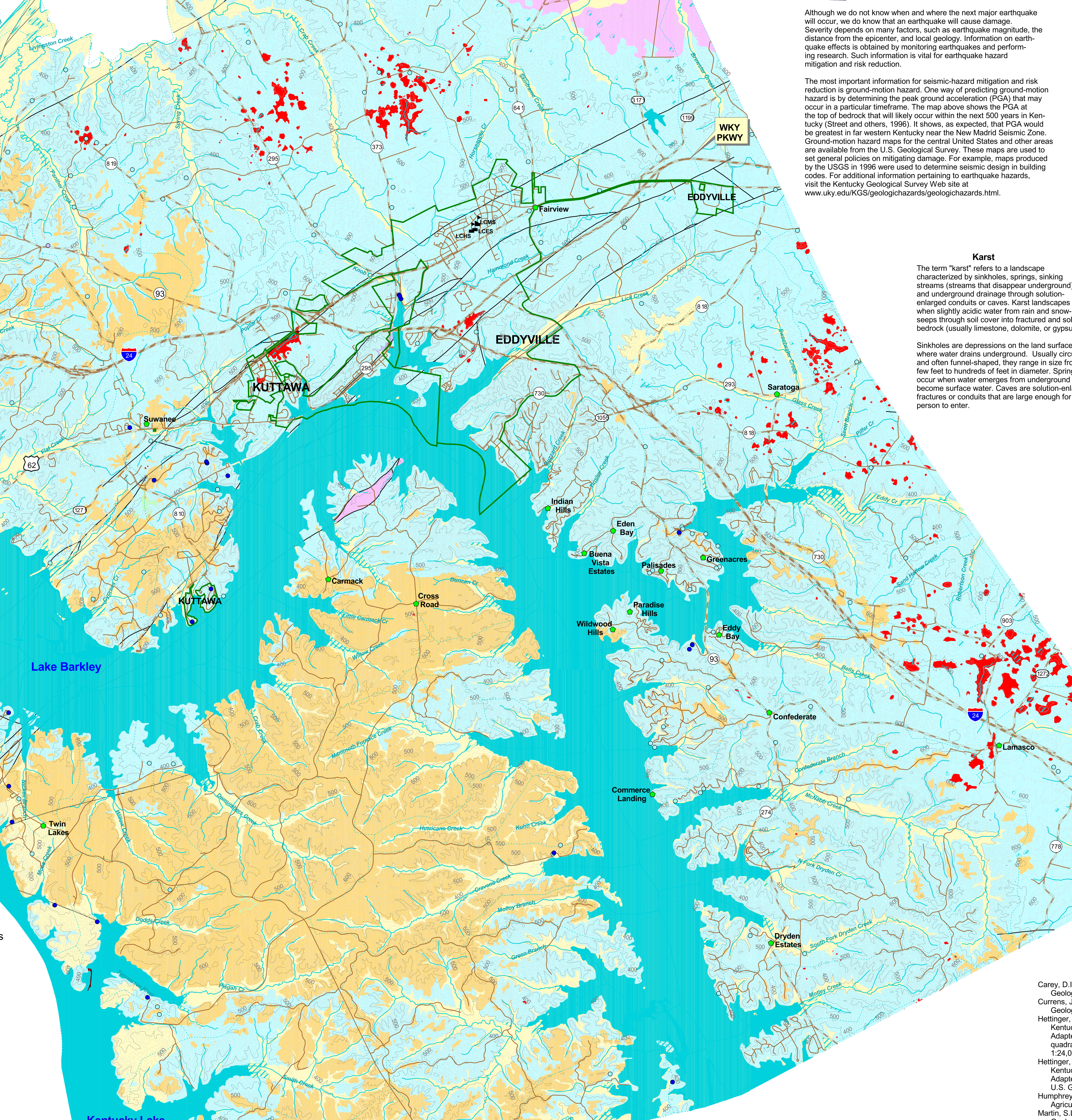
- School
- Urban service boundary
- Watershed divide
- Wetlands > 1 acre, (U.S. Fish and Wildlife Service, 2003)
- Water
- Artificial fill
- Sinkholes
- Watershed divide
- Concealed faults
- Faults
- Secondary faults

Water Wells
- Domestic
- Industrial
- Public
- Monitoring

20-foot contour interval

For Planning Use Only

This map is not intended to be used for selecting individual sites. Its purpose is to inform land-use planners, government officials, and the public in a general way about geologic bedrock conditions that affect the selection of sites for various purposes. The properties of thick soils may supercede those of the underlying bedrock and should be considered on a site-to-site basis. At any site, it is important to understand the characteristics of both the soils and the underlying rock. For further assistance, contact the Kentucky Geological Survey, Western Kentucky Office, 1401 Corporate Court, Henderson, KY 42420, phone 270.827.3414 or 270.827.3404. For more information, and to make custom maps of your local area, visit our Land-Use Planning Internet Mapping Web Site at kgsmap.uky.edu/website/kyluplan/viewer.htm.



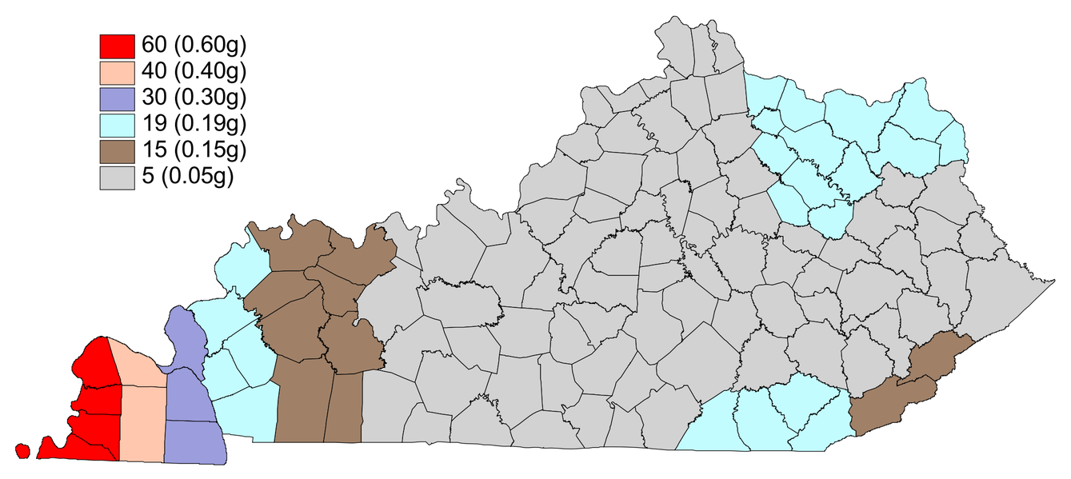
Geologic Hazards

Many concealed and exposed faults are located throughout Lyon County. Currently, there is no evidence that these faults are active. Because of the proximity of Lyon County to the New Madrid Seismic Zone, however, strong earthquake activity is a possibility. Soil creep, slumps, and landslides along steep slopes may occur from erosion or ground motion associated with a strong earthquake.

Areas associated with saturated alluvium (unit 1) and other unconsolidated deposits (units 2 and 3) are subject to liquefaction during a strong earthquake. Alluvium deposits are also subject to flooding. Soils derived from alluvium deposits have a moderate to high shrink-swell capacity, which may affect structural foundations and roads. Flood information is available from the Kentucky Division of Water, Flood Plain Management Branch, www.water.ky.gov/floods/.

Earthquake Hazard Information

Peak ground acceleration at the top of rock that will probably occur in the next 500 years in Kentucky



Although we do not know when and where the next major earthquake will occur, we do know that an earthquake will cause damage. Severity depends on many factors, such as earthquake magnitude, the distance from the epicenter, and local geology. Information on earthquake effects is obtained by monitoring earthquakes and performing research. Such information is vital for earthquake hazard mitigation and risk reduction.

The most important information for seismic-hazard mitigation and risk reduction is ground-motion hazard. One way of predicting ground-motion hazard is by determining the peak ground acceleration (PGA) that may occur in a particular timeframe. The map above shows the PGA at the top of bedrock that will likely occur within the next 500 years in Kentucky (Street and others, 1996). It shows, as expected, that PGA would be greatest in far western Kentucky near the New Madrid Seismic Zone. Ground-motion hazard maps for the central United States and other areas are available from the U.S. Geological Survey. These maps are used to set general policies on mitigating damage. For example, maps produced by the USGS in 1996 were used to determine seismic design in building codes. For additional information pertaining to earthquake hazards, visit the Kentucky Geological Survey Web site at www.uky.edu/KGS/geologichazards/geologichazards.html.

Sinkholes

Sinkholes are common in Lyon County. Generally, sinkholes begin as small depressions like the one pictured above, which is about 3 feet in diameter. While planting or harvesting at the Western Kentucky Correctional Complex, tractors often run over these depressions, which then collapse, causing the tractor to become stuck. Photo by Glynn Beck, Kentucky Geological Survey.

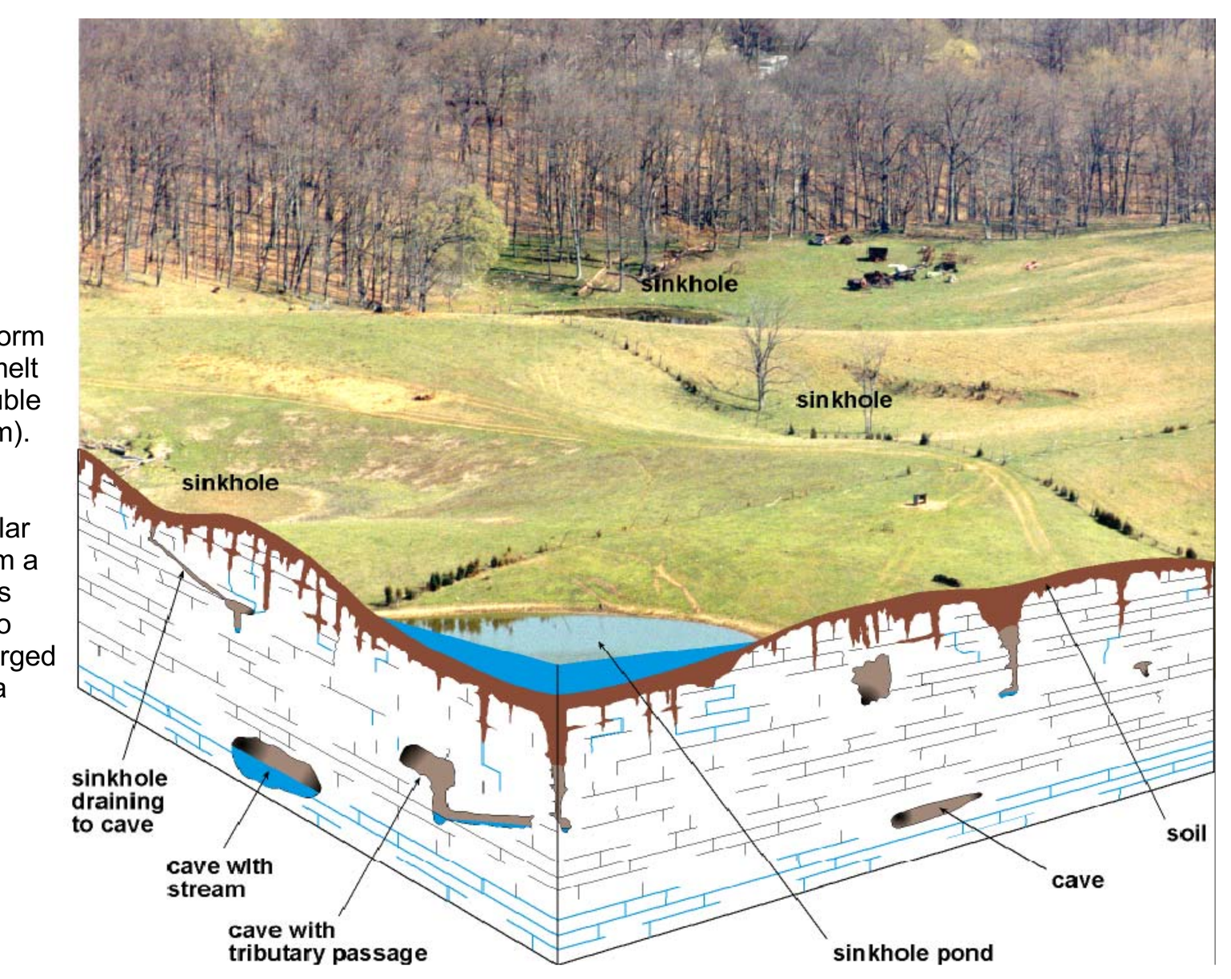
Sinkholes and soil erosion are two major issues to consider in land-use planning in Lyon County. Both are encountered at the Lee Jones Lyon County Recreational Park. The above baseball field is being moved because of the formation of a small sinkhole in the old infield (top right center). Also, soil erosion is occurring along rocked drainages (foreground). Photo by Glynn Beck, Kentucky Geological Survey.

Karst

The term "karst" refers to a landscape characterized by sinkholes, springs, sinking streams (streams that disappear underground), and underground drainage through solution-enlarged conduits or caves. Karst landscapes form when slightly acidic water from rain and snow-melt seeps through soil cover into fractured and soluble bedrock (usually limestone, dolomite, or gypsum).

Sinkholes are depressions on the land surface where water drains underground. Usually circular and often funnel-shaped, they range in size from a few feet to hundreds of feet in diameter. Springs occur when water emerges from underground to become surface water. Caves are solution-enlarged fractures or conduits that are large enough for a person to enter.

Environmental Protection



Never use sinkholes as dumps. All waste, but especially pesticides, paints, household chemicals, automobile batteries, and used motor oil, should be taken to an appropriate recycling center or landfill.

Make sure runoff from parking lots, streets, and other urban areas is routed through a detention basin and sediment trap to filter it before it flows into a sinkhole.

Make sure your home septic system is working properly and that it's not discharging sewage into a crevice or sinkhole.

Keep cattle and other livestock out of sinkholes and sinking streams. There are other methods of providing water to livestock.

See to it that sinkholes near or in crop fields are bordered with trees, shrubs, or grass "buffer strips." This will filter runoff flowing into sinkholes and also keep tilled areas away from sinkholes.

Construct waste-holding lagoons in karst areas carefully, to prevent the bottom of the lagoon from collapsing, which would result in a catastrophic emptying of waste into the groundwater.

If required, develop a groundwater protection plan (410KAR5:037) or an agricultural water-quality plan (KRS224.71) for your land use.

(From Currens, 2001)

Additional Planning Resources

Listed below are Web sites for several agencies and organizations that may be of assistance with land-use planning issues in Lyon County:

www.lyoncounty.com/—Lyon County
ces.ca.uky.edu/lyon/—University of Kentucky Cooperative Extension Service
www.peadd.org/—Pennyrile Area Development District
www.thinkkentucky.com/edis/cmnty/cw127/—Kentucky Economic Development Information System
www.uky.edu/KentuckyAtlas/21143.html—Kentucky Atlas and Gazetteer
quickfacts.census.gov/qfd/states/21/21143.html—U.S. Census data
kgsweb.uky.edu/download/kgsplanning.htm—Planning information from the Kentucky Geological Survey

Groundwater

In the eastern and northern two-thirds of Lyon County, more than three-quarters of the drilled wells in the uplands are adequate for a domestic supply. Yields as high as 50 gallons per minute have been reported from wells penetrating large solution channels. In the low-lying areas of Eddy Creek most wells are inadequate for domestic use unless the well intercepts a major solution opening in the limestone; in that case, the yield could be very large. Wells in the uplands of the Land Between the Lakes in the southwestern quarter of the county generally do not yield enough water for domestic use. In the lowlands adjacent to Kentucky and Barkley Lakes, however, three-fourths of the wells located within the bedrock yield enough for a domestic supply and can sometimes produce more than 5 gallons per minute. Springs with flows ranging from a few gallons per minute to 1,280 gallons per minute are found in the county. Minimum flow generally occurs in early fall, maximum flows in late winter. For more information on groundwater in the county, see Carey and Stickney (2001).

PLANNING TABLE DEFINITIONS

FOUNDATION AND EXCAVATION

The terms "earth" and "rock" excavation are used in the engineering sense; earth can be excavated by hand tools, whereas rock requires heavy equipment or blasting to remove.

LIMITATIONS

Slight—A slight limitation is one that commonly requires some corrective measure but can be overcome without a great deal of difficulty or expense.

Moderate—A moderate limitation is one that can normally be overcome but the difficulty and expense are great enough that completing the project is commonly a question of feasibility.

Severe—A severe limitation is one that is difficult to overcome and commonly is not feasible because of the expense involved.

LAND USES

Septic tank disposal system—A septic tank disposal system consists of a septic tank and a filter field. The filter field is a subsurface tile system laid in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil.

Residences—Ratings are made for residences with and without basements because the degree of limitation is dependent upon ease and required depth of excavation. For example, excavation in limestone has greater limitation than excavation in shale for a house with a basement.

Highways and streets—Refers to paved roads in which cuts and fills are made in hilly topography, and considerable work is done preparing subgrades and bases before the surface is applied.

Access roads—These are low-cost roads, driveways, etc., usually surfaced with crushed stone or a thin layer of blacktop. A minimum of cuts and fills are made, little work is done preparing a subgrade, and generally only a thin base is used. The degree of limitation is based on year-around use and would be less severe if not used during the winter and early spring. Some types of recreation areas would not be used during these seasons.

Light industry and malls—Ratings are based on developments having structures or equivalent load limit requirements of three stories or less, and large paved areas for parking lots. Structures with greater load limit requirements would normally need footings in solid rock, and the rock would need to be core drilled to determine presence of caverns, cracks, etc.

Intensive recreation—Athletic fields, stadiums, etc.

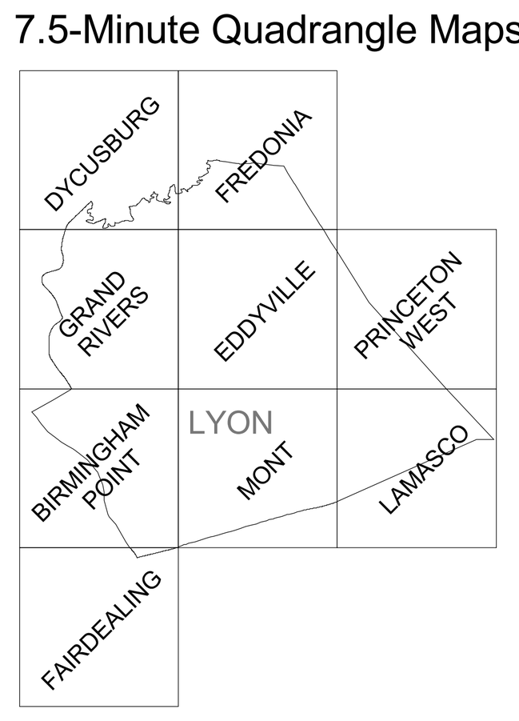
Extensive recreation—Camp sites, picnic areas, parks, etc.

Reservoir areas—The floor of the area where the water is impounded. Ratings are based on the permeability of the rock.

Reservoir embankments—The rocks are rated on limitations for embankment material.

Underground utilities—Included in this group are sanitary sewers, storm sewers, water mains, and other pipes that require fairly deep trenches.

7.5-Minute Quadrangle Maps



Planning Guidance by Rock Unit Type

Rock Unit	Foundation and Excavation	Septic Tank Disposal System	Residence with Basement	Highways and Streets	Access Roads	Light Industry and Malls	Intensive Recreation	Extensive Recreation	Reservoir Areas	Reservoir Embankments	Underground Utilities
1. Alluvium	Fair to good foundation material. Easily excavated.	Refer to soil report (Humphrey, 1981).	Refer to soil report (Humphrey, 1981).	Refer to soil report (Humphrey, 1981).	Refer to soil report (Humphrey, 1981).	Refer to soil report (Humphrey, 1981).	Refer to soil report (Humphrey, 1981).	Refer to soil report (Humphrey, 1981).	Refer to soil report (Humphrey, 1981).	Refer to soil report (Humphrey, 1981).	Refer to soil report (Humphrey, 1981).
2. Gravel	Fair to good foundation material. Moderately difficult excavation.	Slight to moderate limitations. Variable thickness and permeability.	Severe to moderate limitations. Shallow groundwater table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight limitations.	Slight limitations.	No limitations.
3. Sand, clay, gravel, and silt	Fair to good foundation material.	Slight to moderate limitations. Variable materials. Low-permeability zones possible.	Slight limitations. Shallow groundwater table may be present.	No limitations.	No limitations.	No limitations.	No limitations.	No limitations.	Slight to moderate limitations. Permeable materials possible.	Slight to moderate limitations. Permeable materials possible.	No limitations.
4. Limestone	Excellent foundation material. Difficult to excavate.	Severe limitations. Impermeable rock; locally fast drainage through fractures, danger of groundwater contamination.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Sinks possible, drainage required.	Slight to moderate limitations. Rock excavation; locally upper few feet may be rippable. Sinks possible, drainage required.	Slight limitations. Local drainage problems from seeps or springs; sinks possible.	Slight to moderate limitations, depending on topography. Rock excavation; locally, upper few feet may be rippable. Sinks possible; local drainage problems.	No limitations.	No limitations.	Severe limitations. Leaky reservoir rock; locally, conditions may be favorable. Sinks possible.	Severe limitations.	Severe limitations. Rock excavation.
5. Limestone, shale, sandstone, siltstone	Fair to good foundation material. Difficult excavation.	Severe limitations; thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Moderate limitations. Rock excavation. Steep slopes.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Severe limitations. Steep slopes.	Severe limitations. Steep slopes.	Slight limitations. Reservoir might leak where rocks are fractured.	Severe limitations.	Moderate limitations. Highly variable amount of soil and rock excavation. Steep slopes.
6. Shale	Fair to good foundation material. Difficult to excavate. Possible pyrite expansion in shales.	Severe limitations; thin soils and impermeable rock.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Possible steep slopes.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Possible steep slopes.	Moderate limitations. Rock excavation. Steep slopes.	Severe to moderate limitations. Rock excavation; locally, upper few feet may be rippable. Steep slopes.	Severe to slight limitations, depending on type of activity and topography. Possible steep wooded slopes.	Severe limitations. Steep slopes.	Slight limitations. Reservoir might leak where rocks are fractured.	Severe limitations.	Severe to moderate limitations. Possible rock excavation.

N

Scale 1:48,000

1 inch = 3/4 mile

2 0 2 4 Miles

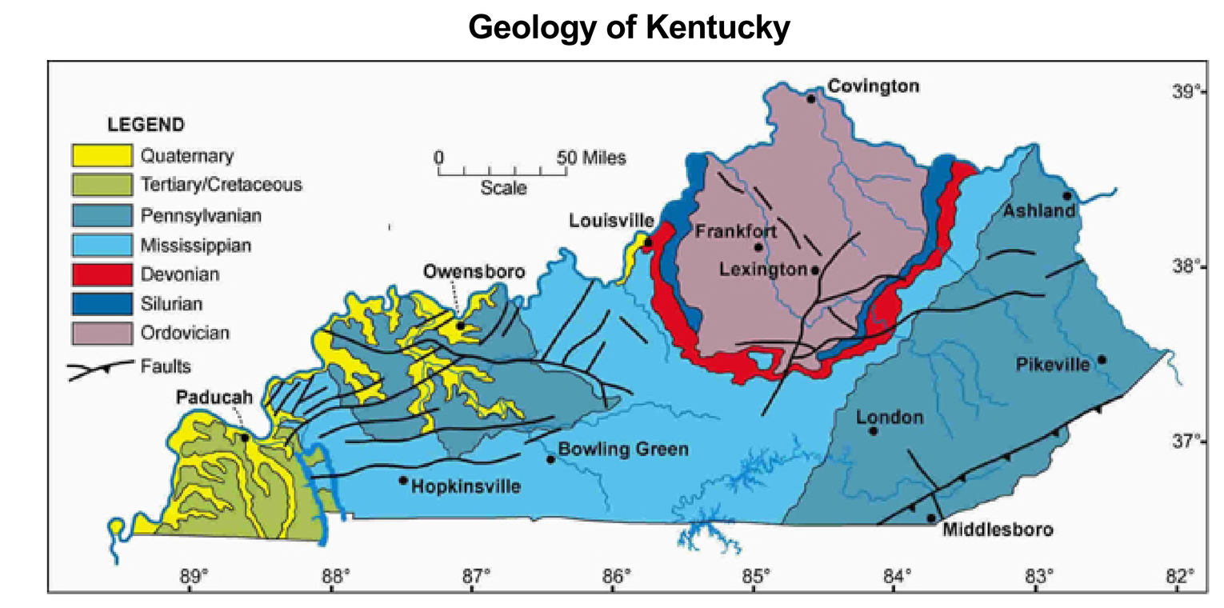
3 0 3 6 Kilometers

For information on obtaining copies of this map and other Kentucky Geological Survey maps and publications call:

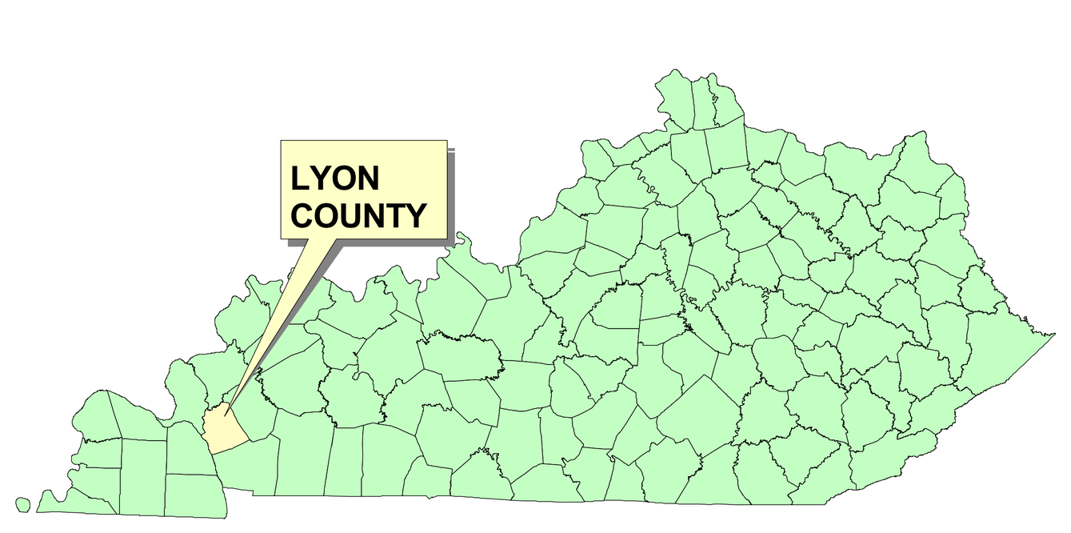
Public Information Center
859.257.3896
877.778.7827 (toll free)

View the KGS World Wide Web site at:
www.uky.edu/kgs

Geology of Kentucky



Learn more about Kentucky geology at www.uky.edu/KGS/geoky/



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